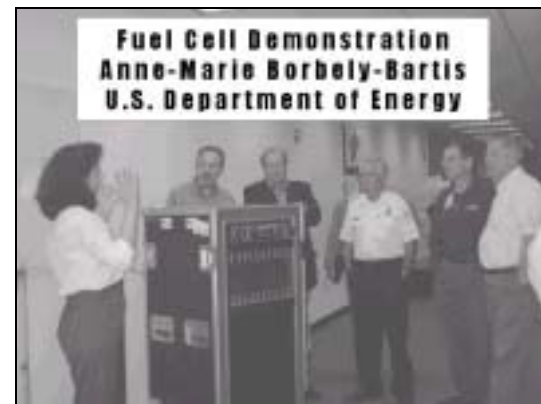
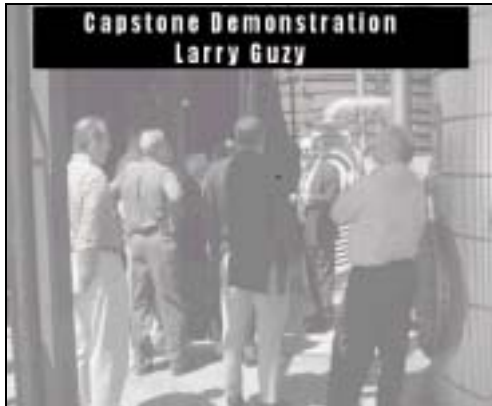


Distributed Energy Road Show

Clemson, South Carolina

April 23, 2003

The Building Codes Council of the Labor Licensing & Regulations Board of South Carolina approved 5.5 CEUs for this meeting. In addition, Piedmont Natural Gas offered 5 Professional Development Hours.



Agenda

- 8:30 Coffee & Registration
- 9:00 Welcome
Dr. Lawrence Golan, Director, Institute for Energy Studies, Clemson University
Mr. Mitchell Perkins, Director of Energy Programs, South Carolina Energy Office
- 9:20 DE: The National Perspective
Ms. Anne-Marie Borbely-Bartis, Battelle at U.S. Department of Energy
- 9:50 Hydrogen: Basics and Use
Ms. Anne-Marie Borbely-Bartis, Battelle at U.S. Department of Energy
- 10:10 Fuel Cells: Installation and Operation
Mr. Samuel Logan, Logan Energy
- 10:40 DG Interconnection
Mr. John Fayssoux, Energy Procurement Group
- 11:10 Break
- 11:30 South Carolina Air Regulations affecting DG
Ms. Diana Zakrzewski, SC DHEC, Air Permitting
- 12:00 p.m. Lunch
- 12:45 Microturbines: Installation and Operation
Mr. Larry Guzy, Capstone Turbine Corp.
Mr. T. Minh Tran, Piedmont Natural Gas
- 1:30 Reciprocating Engines: Installation and Operation
Mr. Gene Gosnell, Blanchard Machinery, a SC Caterpillar Distributor
- 2:00 Introduction to the Energy Systems Laboratory
Mr. Jeff Hinson, Energy Systems Laboratory
- 2:15-3:30 Tour of Energy Systems Laboratory
Hands-on training with a working microturbine and reciprocating engine
- 4:00 Structured Discussion and Q & A
Ms. Anne-Marie Borbely-Bartis, Battelle at U.S. Department of Energy
- 4:30 Adjourn

Workshop Notes – Q & A

DE: The National Perspective

Q: Has there been any recent discussion at the national level regarding assigning “wellhead costs” to energy (a term used a lot in the 1970s)? I have not heard that term in a while.

A: At the national level, no. Energy “ROI” is being used in the automotive industry these days, but nowhere else.

Q: Has the U.S. Department of Energy been testing the Stirling cycle engine?

A: No, we have not started testing the Stirling engine ourselves. Yes, we are testing externally-fired engines. Stirling Motors of Michigan has begun working with the U.S. DOE on Stirling cycle engines.

Q: Would you classify Stirling engines in the same “distributed energy” class as fuel cells?

A: Yes.

Comment: Explosive limits for the different fuels are complicated.

Comment: An “H₂-only” education and outreach program is currently being developed at the U.S. DOE. These DE road shows are the “first generation” of exposure. Next week a Hydrogen technologies meeting will be held at the Florida Solar Energy Center in Cocoa, Fla. An agenda for this meeting will be included with the certificates you will receive at the end of the day today.

Q: Would you do education and outreach for other hydrocarbons too?

A: Yes.

Q: You’ve discussed life and safety issues. What about health issues? (carcinogens, etc.)

A: For things like MTBE, yes - such health issues are a consideration today. For the technologies we will discuss here today, such health issues are not being studied yet.

Hydrogen: Basics and Use

Q: Where do insurance companies fall into this?

A: Currently there are beta-testing riders on insurance policies – typically lasts three months. Insurance will be a major issue as units are deployed across the U.S.

Fuel Cells: Installation and Operation

Q: PEM fuel cells operate at such a low temperature. The waste heat is only suitable for heating water. Other fuel cell technologies operate at higher temperatures. Is anyone providing steam applications?

A: Cooling provides a very attractive application for waste heat. For example, one can package an absorption chiller (e.g. 20 tons cooling) with a DG technology. The Phosphoric Acid Fuel Cell (PAFC) has the most significant value, but is not suitable for all HVAC applications. Unfortunately, the PAFC is too expensive.

Comment: PEM - An upcoming "membrane electrode assembly" is under development. Will be able to run temperatures of up to 300 degrees Fahrenheit or more. However, we will not see this for a few more years.

Q: If you have a PEM fuel cell and 100 watts/units of fuel, how much energy would you get?

A: Let's put it in terms of Btus. If you take a Plug Power 5 kW unit, that is 50,000 Btus. We'll have 18,000-20,000 Btus in heat. Assume 25% electrical efficiency. We can do the math to see what is then usable and what is parasitic.

Q: What is the Nitrogen used for (as shown on Slide 14, "Applications – Typical Site Layout")?

A: Used for purging. (Inert gases, such as nitrogen or helium, are commonly used for this purpose.)

Q: Is there a monitoring system available?

A: Yes, there is a service interface – we use a laptop with a serial port connection. Any fuel cell system will typically have a modem or Internet connection and also an alarm to notify the manager.

Q: I see that the system operates off of natural gas. Do you have a converter?

A: First thing: natural gas is processed. Second: it is put into a reformer. (See previous slides in your handouts for more details.)

Q: What kinds of by-products are produced during the reformation process?

A: SO_x and CO are produced when the reformer is heating up.

Q: Where is the line of demarcation between the user's responsibility and the supplier's responsibility for codes and standards?

A: Supplier will sell you a box with components. If PEM fuel cell, it will be "stickered." Manufacturer will also give you an installation guide. It will be up to you as the owner to see that the codes and standards are being met. NEC 2002 is most recent – has 18-20 pages on fuel cells for the first time. NFPA 853 - Standard for the Installation of Stationary Fuel Cell Power Plants (also adopted NEC version).

Comment: *Caution* – there may be local standards that are not included in the above-referenced codes.

Q: Efficiency – Is a PEM fuel cell without heat recovery less efficient than the typical central plant power station?

A: Central plant power stations are usually 30-35% efficient, maybe 40%. So, yes, the efficiency of a **PEM** fuel cell without heat recovery is typically less than that.

Q: I noticed on one of your slides that the Omaha National Bank installation is indoors. What issues do you have to deal with for indoor installations?

A: Exhaust ventilation: make sure you have the correct volume of air. Also, additional steps must be taken for indoor installations.

DG Interconnection

Q: Are the FERC interconnection discussion agreements part of the upcoming FERC Standard Market Design (SMD)?

A: Yes, it will all be tied together.

South Carolina Air Regulations affecting DG

Q: What about CO₂?

A: Yes for CO.

Q: Are permit applications a matter of public record?

A: Yes, you can see which facilities have applied for permits on-line at our web site <http://www.scdhec.net/baq/>.

Q: What is air dispersion modeling?

A: I am not a modeler so perhaps I am not the best person to answer this question. Air pollution meteorology and dispersion models include the SCREEN model and the ISC AERMOD models.

Microturbines: Installation and Operation

Q: Was that a fuel gas compressor?

A: Yes, available for C-30s. An alternative is the Copeland compressor (external).

Q: What are the time units?

A: Less than two minutes to start.

Q: The slide on load management for the fire station: was that baseload? (That seems too high to be baseload.)

A: We were looking at demand at several fire stations so it was designed for the maximum. The peak load on that building is greater than one microturbine; that's why we used two.

Q: Do you have any information on installation cost?

A: Yes, the installation cost was approximately \$30,000, so it was close to the number quoted in an example by Anne-Marie Borbely-Bartis in her first presentation this morning.

Reciprocating Engines: Installation and Operation

No questions

Introduction to the Energy Systems Laboratory

No questions

Structured Discussion and Q & A

Overall Question Posed to Attendees:

What do you think of the idea of distributed energy?

Comment: It is a good idea to go around the country to introduce these technologies. However, is distributed energy a long way from reality?

Q: The “whims of the Administration” – is your U.S. DOE budget subject to this?

A: All of the education and outreach efforts have been completely signed off on.

Overall Question Posed to Attendees:

Federal, State, and Local regulations – what variances do you have?

Q: Is there an appellate process?

A: Yes. First, you need preliminary review.

Q: Is there an appeal above and beyond the local code official?

A: Yes. Board of the State Chapter of the Code Council says whether code official’s interpretation is right or wrong. This Board is always local to the jurisdiction. You can always appeal to the Civil Court System. They will either accept or deny.

Q: We keep referring to H₂ as a fuel. Is it a fuel or a storage medium?

A: It is an administrative and legislative process to define H₂. It is currently classified as a hazardous substance.

Q: Does it take more energy to create H₂ fuel than you get out of it?

A: Not necessarily. Depends on how you are creating it.

Q: Has the Administration abandoned the idea of hybrid cars?

A: No, it has not been abandoned. Federal tax credits are available, as well as state tax credits (in some states).

Overall Question Posed to Attendees:

Are there any other technologies you would like to hear about?

Comment: More on renewable fuel sources. For example, what about microturbines that run on ethanol from corn? I don't hear much about where the funding for renewables goes these days.

Overall Question Posed to Attendees:

Did we cover enough per technology?

Comment: Yes, a good mix, and good information.

Overall Question Posed to Attendees:

Who else should we invite in?

Comment: More consulting engineers since they will have an inherent resistance to these technologies.

Overall Question Posed to Attendees:

What about City and County planners?

Comment: Yes.

Comment: Speaking on behalf of Caterpillar, all of the various codes are definitely barriers. The fuel cell presentation today identified that. Caterpillar has an alliance with Fuel Cell Energy in Connecticut. We've heard horror stories about never being able to turn on the fuel cell after spending time and money on installation.

Response: On the U.S. DOE's web site, a May 2000 report called "Making Connections" <http://www.nrel.gov/docs/fy00osti/28053.pdf> lists similar horror stories.

A U.S. DOE-sponsored report entitled "Clearing the Air" discusses air permitting-related DG issues.

Q: Have you thought about targeting specific users (e.g., universities, industrial parks, hospitals)?

A: Yes. We definitely need to have users, consulting engineers, and building code officials all in the same room.

Q: DG developers have been trying to find their “market” for years now. Where is the market now?

A: Very good question. What does the group think about residential DG?

Comment: “Thumbs down” to residential DG. People don’t want that responsibility.

Q: What if community energy was set up?

A: That’s not residential then, is it?

Comment: Must be economically feasible. Also, until it is like a refrigerator then residential customers will not want it. Even then, they may not want it. The grid has got to be there.

Comment: We are struggling to see how we “fit in” with residential deregulation, customer choice, etc.

Overall Question Posed to Attendees:

Is there anything else at the National level that you would like to hear...other options?

Comment: Offer buy-down assistance.

Q: What if the fuel cell support dries up? What will happen to R&D?

A: In Washington D.C., any initiative can be started BUT appropriations may not be made. Congress determines what actually gets funded.

Q: Of the \$2 Billion recently announced by the President, how much is going to be given as buy-down assistance?

A: None.

Comment: Direct capital cost assistance is needed.

Overall Question Posed to Attendees:

What about technical assistance?

Comment: This today was a good start.

Comment: Life safety is the building code official’s greatest concern. The rest of it is up to UL, etc. You also have setback issues for zoning that you have to deal with.

Comment: Clark County, Nev., firemen were trained on technologies at a DE road show. They requested signage and GPS systems.

Q: What about testing of the equipment itself?

A: Yes, we are working on that for H2.

Overall Question Posed to Attendees:

What would be a good way to get information out?

Comment: The National Fire Academy would be a good venue. Also, volunteer fire departments.

Q: Transportation?

A: A joint task force is currently being formed to look at H₂ systems and safety standards. DOT's NHTA looks at vehicle impact.

Q: Can the President issue an Executive Order to install distributed energy in Iraq?

A: We will pass that information on.

Q: What is being done about H₂ at refueling stations?

A: We are working on R&D at various gasoline fueling stations. Las Vegas, Palm Springs for example.

Comment: Another way to get information out would be the state fire academies. The South Carolina Fire Academy would be a good place to hold training (easy travel, etc.) Also, NFPA – they are pretty good about issuing such codes.

Comment: Issue – University of South Carolina – we are wondering where to store the H₂. Fuel cell backup for telecommunications. Backup cheaper to store H₂ than having reformer. Rather have it inside, stored and locked up.

Comment: H₂ is smallest molecule known. In a large room like this, it would disperse.

Comment: We need an NFPA standard for H₂ indoors. We also need information about dispersion.

Q: What about a 5,000 psi automobile in your car garage under your house? What if it leaks?

A: We need to discuss how volatile H₂ is. Dispersion in rooms, etc. Everyone has gasoline in his or her garage; it is a matter of familiarity.

Comment: Education is a big issue. There are misunderstandings about H₂.

Overall Question Posed to Attendees:

What if you were e-mailed a CD? Web training?

Comment: Yes, that would be convenient. We would also have the CD for reference.

Comment: We need to “train the trainers.” Perhaps use smaller academic institutions to do so and then move up to larger universities such as Clemson. For example, the University of Central Florida has a DG curriculum.